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MONITORING THE QUALITY OF SUNFLOWER SEED BEFORE AND DURING STORAGE

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Storage life of sunflower seed can be increased by monitoring the quality of seed before and during the storage period. Cold test, accelerated and modified accelerated aging test, in which several germination tests were made over time were evaluated. Modified accelerated aging test was found to be a more reliable method of seed quality evaluation. Seed lots having P_{50} viability period (period when germination drops to 50%) of 3.5 and above could be stored safely upto one year in conducive environmental conditions.

Key words: Accelerated aging, Viability, Seed vigor, Storage.

Introduction

Pakistan is one of the major edible oil importing countries in the global market. The import of edible oil costs billions of rupees in foreign exchange each year. To reduce the burden of this heavy foreign exchange deficit, many public and private sector seed agencies have taken up production of oilseed crops. Sunflower is one of the major oilseed crops under production in the country as a source of edible oil. Presently, most of the companies are importing hybrid sunflower seeds for crop production.

Sunflower seed, being high in oil content, tends to deteriorate very quickly during storage. It is very difficult to keep sunflower seed in store for a long period of time without substantial deterioration under ordinary storage environments, especially under high moisture and temperature conditions. Viability of seed lots carried over from the previous year is a problem for seed producers. The only solution of this problem at present is to monitor the quality of seed during and after storage.

Several techniques have been developed for the evaluation of seed quality (potential of seed to germinate), but no specific technique is recommended for sunflower seed. In the present study, cold test, accelerated aging test and modified accelerated aging techniques [1-3] are evaluated as indicators of sunflower seed quality.

Materials and Methods

Four hybrids of sunflower seed were obtained from Lever Brothers (Pvt.) Ltd., Lahore and Ghee Corporation of Pakistan. The seed lots were treated with Capton fungicide. Moisture test and standard germination tests were conducted as the seeds were received in laboratory (Table 1).

As no particular vigor test is prescribed for sunflower seed, three vigor tests i.e., cold test, accelerated and modified accelerated aging tests were used for the purpose of evaluation and monitoring the quality of seed.

Cold test. Standard procedures for corn [4] were used for evaluation of sunflower seed. The soil for the cold test was collected from an area where sunflower was grown in the previous season. It was sieved through a 2 mm diameter round-hole screen to remove debris and its moisture content and water holding capacity (i.e., capillary saturation) were determined [4]. Cold tests were carried out in aluminium pans by placing the seeds between 2 cm thick layer of soil. Water cooled to 10°C was then added to bring the medium to 70% saturation. The pans were covered with tight lids and placed at 10°C for 7 days, after which they were transferred to a room maintained at a constant 25°C for 4 days. Cold test emergence was determined by counting the emerged seedlings and calculating the average percent emergence for the four 100 seed replicates.

Accelerated aging test. The test was conducted according to the standard earlier procedure [4]. Seeds were placed one layer deep in the wire mesh tray set on a rack in a plastic box containing 40 ml water (water level was below the wire mesh tray). The box was covered with a tight fitting lid and placed in an incubator at 42°C for 72 hrs. At the end of the aging period, standard germination test (ISTA) was performed

TABLE 1. IDENTITY, INITIAL MOISTURE CONTENT AND GERMINATION PERCENTAGE OF FOUR SEED LOTS OF HYBRID SUNFLOWER USED IN THE STUDIES.

Lot* No.	Source	Initial moisture %	Germination %
1	Lever Brothers (Pvt.) Ltd.	11.5	91A
2	-do-	12.00	92A
3	-do-	11.75	90A
4	Ghee Corporation of Pakistan	11.00	90A

*Lot no. are not actual. These were used only for identification in studies.

and the results - mean of 4× 100 seeds expressed as the accelerated aging response.

Modified accelerated aging test. Modified accelerated aging test was carried out as recommended earlier [2,3] to monitor the quality of seeds at the time of entry and during the storage. Seeds were adjusted to 16% moisture content by spraying distilled water on them. Volume of the water was calculated on the basis of initial moisture contents of seeds. After spraying with water, seeds were wrapped in polythene and placed in refrigerator for 10 days to balance the seed moisture contents. The seeds were then wrapped in three folds of aluminium foil and placed in incubator at 40°C for a period of 10 days. Samples were drawn every day and standard germination test (ISTA) was conducted. Four replicates of 100 seeds each were planted in rolled paper towels and germinated at 25°C ± 2°C. The counts were made after 4 and 7 days. The number of normal seedlings for each treatment was determined and expressed as a percentage.

Results and Discussion

Cold test. Germination response from the cold test (Table 2) indicated that lot 2 had the highest vigor, lot 1and 3 had moderate vigor levels whereas performance of lot 4 was poor.

Accelerated aging test. Germination data from routine accelerated aging test, when seeds were stored at 100% relative humidity and 42°C for 72 hrs, revealed that lot 2 is the highest in vigor, whereas lot number 1, 3 and 4 had low vigor levels. Lot 2, which had higher vigor level in both cold and accelerated aging tests showeds comparatively better performance when stored under ambient conditions for 12 months. However, results from accelerated aging test when compared with long term storage, were found to be more close to cold test. This conforms to the findings of Delouche and Baskin [5].

The basic assumption behind the accelerated aging test is that the process of deterioration under accelerated aging conditions is similar to that under 'normal' conditions, only the rate of deterioration is enormously increased. Seed lots that maintain viability during accelerated aging are considered good storers while those that have substantially reduced viability are considered poor storers.

TABLE 2. COLD TEST AND ACCELERATED AGING TEST RESULTS OF FOUR SEED LOTS.

Lot No.	Initial germination	Germination % after cold Test	Germination % after accelerated ageing test
1	90	82B	70B
2	92	90A	74A
3	90	84B	62D
4	90	79C	65C

Modified accelerated aging test. Although the results of the accelerated aging test showed the true behaviour of seed lots in storage conditions, yet there were some exceptions. Delouche and Baskin [5] showed that accelerated aging and storage response of a few exceptional seed lots of different cultivars were not at all closely associated. The reasons for these exceptions from the general pattern are not known. However, some evidence suggests that varietal differences might be a factor. Ellis and Roberts [2] and Siddiqui [3] suggested that these differences may be due to single germination count, made after a specified period in accelerated aging test i.e., 84 or 72 hrs, which may not reveal the true pattern of deterioration. To minimize these differences, they recommended more precise method of accelerated aging test and proposed that instead of taking a single germination count, five or six counts over the time should be taken.

Germination data collected at time intervals in modified accelerated aging tests were plotted on linear regression procedure. Mean viability period in days for each seed lot was calculated from the regression equations. P_{50} value (value where germination is dropped 50%) of four seed lots were calculated as 4.37, 4.09, 3.27 and 3.73 for lot nos. 1, 2, 3 and 4 respectively (Fig. 1).

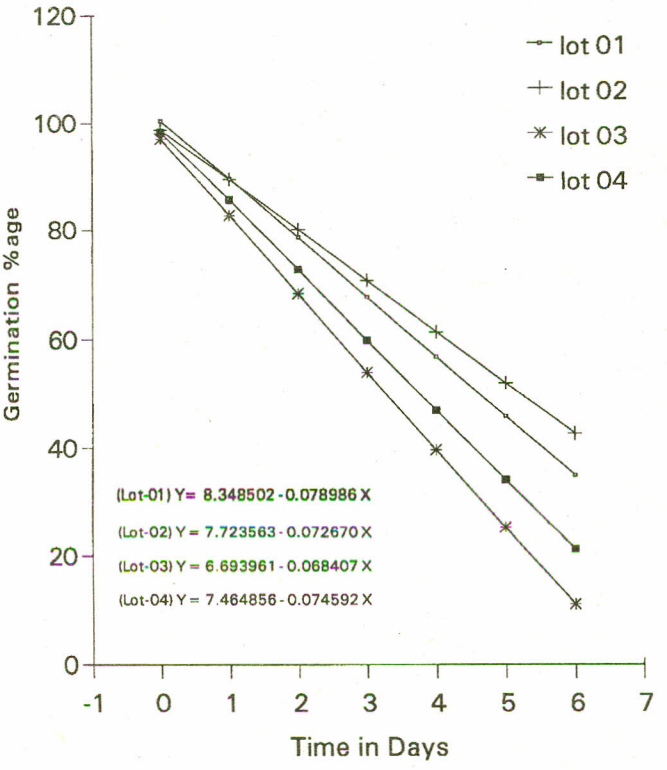

Fig. 1. Resulting regression lines of sunflower seed lots in modified accelerated ageing test.

TABLE 3. GERMINATION RESULTS OF SEED LOTS STORED UNDER AMBIENT CONDITIONS AT FSCD, ISLAMABAD.

Lot No.	Germination percentage after 0 month	3 months	6 months	9 months	12 months
01	91	87	82	70	69
02	92	88	87	79	70
03	90	86	78	68	57
04	90	88	82	79	56

The advantage of modified accelerated aging test over the routine accelerated aging test is that the deterioration of seed at different stages is measured, which gives the clear picture of seed deterioration in storage, whereas in routine test only one count at the end is some times misleading [3].

Seed storage under ambient conditions. Germination percentages of four sunflower seed lots after exposure to several regimes of accelerated aging and interval in laboratory storage condition at Federal Seed Certification Department, Islamabad, are shown in Table 3. With few exceptions, germination responses after accelerated and modified accelerated aging and periods of storage under ambient condition were closely associated. Seed lots that had high survival after accelerated aging test and had high mean viability period stored well, while the lots with low P_{50} viability period were severely reduced in germination due to rapid deterioration in storage.

Precautions. While comparing the results of more than one lot, it is extremely important to precisely control the storage conditions. Temperature should be controlled within a tolerance not greater than 0.5°C. Test duration must also be rigorously adhered to. Samples removed after different intervals should immediately be placed for germination. Initial seed moisture contents have direct effect on the results of accelerated aging vigor test [3,6]. It should be ensured that seed lots being placed for test have the same seed moisture contents. For use of the seed vigor range for sunflower seed devised in the present study, it is recommended that the same conditions and procedures be adopted as used in this experiments. Failing to do so will result in wrong interpretations.

Conclusions

In the light of the present study, it is possible to monitor the quality of hybrid sunflower seed lots before and during the storage period. Modified accelerated aging test is a reliable procedure for evaluation of quality of seed lots. Seed lots having the P_{50} value between 4 and 6 may be safely stored upto one year under suitable moisture and temperature conditions. Seed lots that fall below this range are not recommended to be stored for long period. However, Harrington's [7] rule of thumb that "a one percent decrease in moisture content or 10°F decrease in temperature nearly doubles the storage life of seed" can be applied to enhance the seed storage period.

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